M/035/015
M/035/009

DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF WATER QUALITY

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March 1, 2000

Ms. Paula H. Doughty
Kennecott Utah Copper Corp.
8315 West 3595 South
Magna, UT 84044-6001

Dear Ms. Doughty:

Subject: Tailings Impoundment Ground Water Discharge Permit No. UGW350011
Acid Base Accounting Program

The Division of Water Quality (DWQ) in consultation with the Division of Oil, Gas, and Mining (DOGM) have reviewed Acid Base Accounting (ABA) documents and testing results that have been submitted since project inception in 1995. From our perspectives, KUCC has followed the test guidelines and procedures in the permit and submitted the results in a timely fashion. We appreciate the effort KUCC has expended to attempt to resolve the critical issue of whether the tailings pond embankment and interior materials will oxidize and generate acid at some undetermined date in the future.

ABA Testing Discussion

Based on results submitted in annual reports, there are two material types that plot predominantly within the literature-defined categories of "acid-generating" and "uncertain". These are tailings from the Magna Concentrator and West Cyclone Underflow. Studies conducted by Shepard Miller and Shaffer & Associates for the Tailings Modernization EIS indicated "an increased risk of acid generation exists within embankments constructed for Tailings Impoundment expansion area because the embankments will be constructed of underflow which contains relatively more pyrite". Four of six underflow samples analyzed in 1998 (TLP1488) have neutralization potential ratios that are in the "uncertain" category (Figure 1). Because the humidity cells are not providing conclusive results, DWQ and DOGM are relying on process rules of thumb from research literature to judge static testing program progress and evaluation of need for further testing (Mills, 1999; USEPA, 1994).

Based on submitted results, DWQ is proposing an interim ABA testing schedule as follows:

Sampling Location	Current Schedule	Proposed Schedule next 5 years	Comments
STATIC TESTS			
Copperton Tailings	Monthly	Quarterly for 2 years, Semi-annual thereafter	General indicator of bulk tailings composition
Magna Tailings	Monthly	Quarterly	Unique component of bulk tailings
Cyclone Underflow	Monthly	Quarterly	Surface oxidation concerns during expansion and until surface reclamation
Cyclone Overflow	Quarterly	Semi-annual	
Hydrometallurgical Plant	Annual	Semi-annual	Small volume but variable data, needs more history
Slag Concentrator	Annual	Stop testing	Negligible threat of acid generation
Power Plant Ash	minimum met	Stop testing	Negligible threat of acid generation
KINETIC TESTS			
Humidity Cells			see discussion

Kinetic Testing (Humidity Cells)

The State agrees with KUCC's interpretation that the humidity cell tests conducted to date are not generating results or interpretations that are useful in predicting the future acid-generating behavior of tailings that may become oxidized.

Suggestions for future kinetic testing:

1) Concentrate on testing material that has the most potential to generate acid in the future, keeping in mind the relative percentages that will be contained in the Tailings Impoundment:

   a) Cyclone underflow material - ABA testing has demonstrated that underflow material has a greater percentage of pyritic sulfur than the whole tailings source. With the absence of fines, lower percentage of water, and subaerial exposure during construction and operation of the Tailings Impoundment, this coarse fraction is the most likely to develop acidic conditions.

   b) Magna Concentrator Tailings - Based on the type of ore processed by this facility, the tailings have been demonstrated to have a low ABA value and are at risk of generating

acid (Figure 1). It is acknowledged that the bulk volume of Magna tailings is small, but it is still a component that needs evaluation.

c) Copperton Concentrator Tailings - 1997 Annual Report data indicates a broad spectrum of ABA values, many of which fall into a general range of uncertain, or likely to generate acid range. This probably depends on what part of the ore zone is being mined at the time of sampling and other criteria. Additional testing of selected samples is warranted.

2) Short term kinetic testing has not resulted in conditions that generate acid, even in samples identified as likely by static testing. Rather than run numerous tests for 22 to 26 weeks, select fewer samples and conduct very long term tests, perhaps on the order of 2+ years. (White,2000) This may require modification of the procedure, such as longer periods of drying, less frequent flushing and collection of pH, or other. The State does not have any specific recommendation(s) on the approach and is open to suggestion.

Lysimeters

Continue periodic testing of lysimeters in the area with oxidized mine tailings, and on the Impoundment Step-Back area that has the most likelihood of air influx into the pore space that would create real-time development of arid conditions.

TLL4124
TLL4133
TLL4134
TLL4135

For your information, the references DWQ has used for creating Figure 1 and applying general guidelines are:

Mills, Chris, 1999, Acid Base Accounting (ABA) web page, last updated 09/18/98
http://www.enviromine.com/ard/Acid-Base%20Accounting/ABAdiscussion.htm

U.S. Environmental Protection Agency, 1994, Acid Mine Drainage Prediction, Technical Document EPA 530-R-94-036, Office of Solid Waste, Special Waste Branch.
http://www.epa.gov/epaoswer/other/mining.htm

White, Bill, U.S.Bureau of Land Management, February 2000, personal communication to Wayne Hedberg, DOGM.

If you have any questions or comments concerning the contents of this letter, please contact Ed Hickey at 801-538-9170.

Sincerely,

Dennis Frederick

Dennis Frederick, Manager
Ground Water Protection Section
Division of Water Quality

attachment

DAF/eph:fb

cc: John Callander, Kennecott
Wayne Hedburg, DOGM

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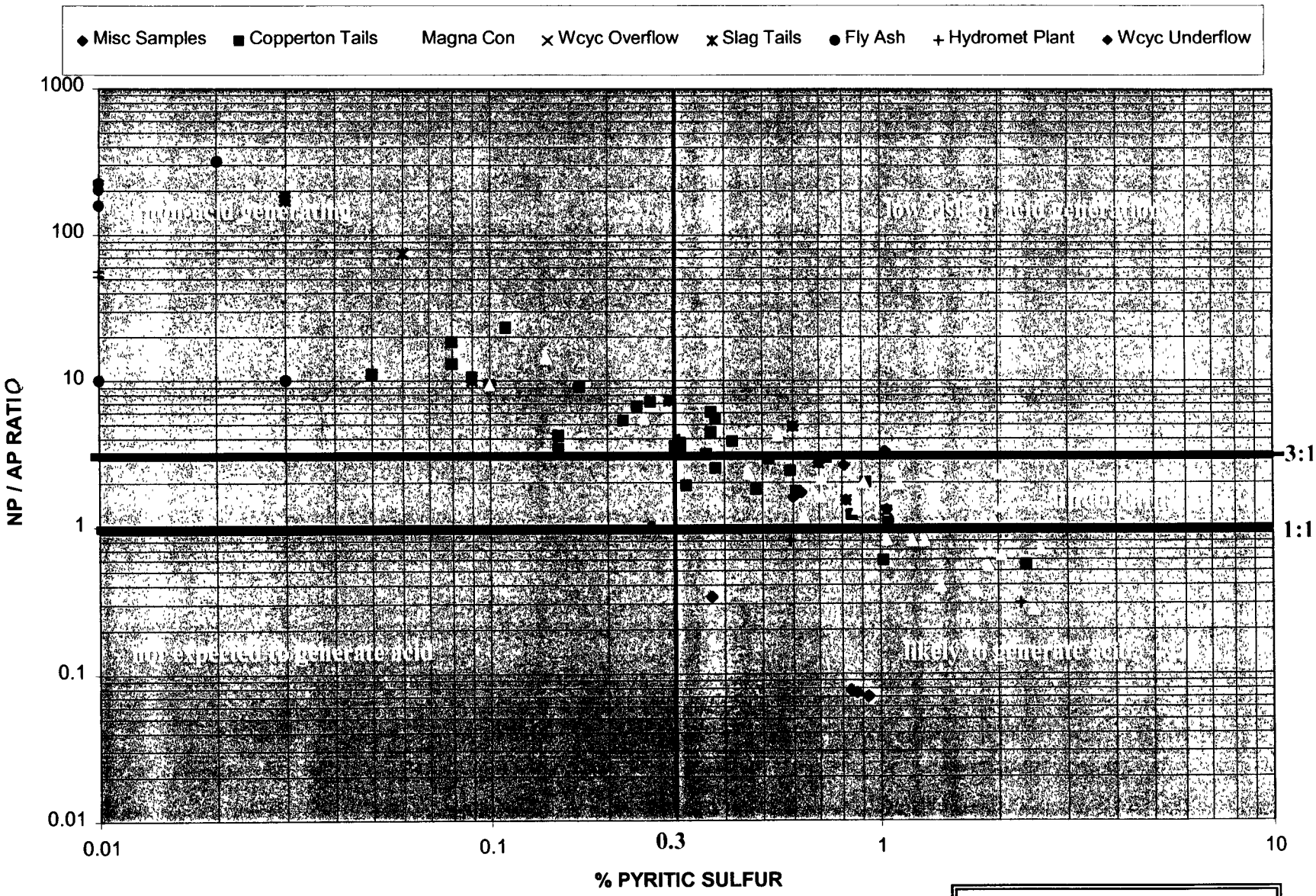
KENNECOTT UTAH COPPER TAILINGS ABA STUDY
NEUTRALIZATION POTENTIAL RATIO vs % PYRITIC SULFUR



Static test results 1996-1998

E. Hickey 02/04/00